

PROCEEDINGS
OF THE
BIOLOGICAL SOCIETY OF WASHINGTON



THE WEST AMERICAN SPECIES OF SHRIMPS OF THE
GENUS PENAEUS.

BY WALDO L. SCHMITT.

On the west coast of America we may recognize five species of shrimps of the genus *Penaeus*:

P. brasiliensis (Latreille) 1817

P. occidentalis Streets 1871

P. stylirostris Stimpson 1871

P. balboae Faxon 1893

P. vannamei Boone 1931

For their better understanding and ready recognition a diagnostic key is presented:

KEY TO THE SPECIES OF *PENAEUS* KNOWN FROM THE WEST COAST
OF AMERICA.

- I. Carapace smooth and shining, may with age become coarsely punctate on the branchial regions, but never scabrous or spinulose, subhepatic crest or ridge, hepatic spine and a lateral portion of the cervical groove a prominent feature; well developed exopodites.
 - A. Lateral rostral sulci extending nearly entire length of carapace. Rostral teeth normally $\frac{9-10}{2}$, usually the first four dorsal teeth are on the carapace.....
brasiliensis Latreille.
 - B. Lateral rostral sulci extending backward to or a little behind the first rostral gastric tooth.
 1. Ventral margin of rostrum normally armed with four to five teeth. Lateral rostral sulci extend behind first dorsal tooth.
 - a. Dorsal rostral teeth run to or near to the tip of the rostrum, never more than the distal third or fourth, often less, of the free portion of the rostrum unarmed above. Rostral teeth usually $\frac{10-11}{4-5}$,

first three dorsal teeth on carapace, sometimes, especially in large adults, the most anterior of the ventral rostral teeth is much reduced, giving the rostrum in superficial inspection a tridentate appearance below*occidentalis* Streets.

b. Approximately distal half or more of free portion unarmed above. Rostral teeth normally $\frac{8}{4-5}$, first three dorsal teeth on carapace.....
stylirostris Stimpson.

2. Ventral margin of rostrum armed with two teeth; distal half of free portion more or less unarmed above; ventral teeth in advance of last dorsal. Rostral teeth $\frac{9-10}{2}$, first four dorsal teeth on carapace. Lateral rostral sulci not extending behind tip or at most base of anterior margin of first dorsal tooth.....*vannamei* Boone.

II. Carapace scabrous, rough spinulose to the touch, and "when viewed through a lens, thickly beset with minute squamiform tubercles"; sides of carapace marked with several not very strong yet noticeable longitudinal carinae; no portion of cervical groove in evidence, no subhepatic ridge or crest, hepatic spine represented by a small spine at about the anterior fifth of the second of the lateral longitudinal carinae. Rostral teeth $\frac{16}{4-5}$, first four dorsal teeth on carapace.....*balboae* Faxon.

Penaeus brasiliensis Latreille.

Penaeus brasiliensis Latreille, Nouv. Dict. Hist. Nat., vol. 25, p. 156, 1817.

Penaeus brevirostris Kingsley, Proc. Acad. Nat. Sci. Philadelphia, vol. 30, p. 98, 1878 (also issued in separate form the same year, spelled in error *Paneus*, description on p. 10 of separate).

Penaeus californiensis Holmes, Proc. California Acad. Sci. (2), vol. 4, p. 581, 1895; Occ. Papers California Acad. Sci., no. 7, p. 218, pl. 4, figs. 64-69, 1900.

Penaeus braziliensis Verrill, Trans. Conn. Acad. Art. Sci., vol. 26, p. 41, pl. 13, figs. 1-3, pl. 16, figs. 1, 2, 2a, pl. 17, fig. 10, a, d, e, f, 1922, and synonymy.

not *Penaeus brevirostris* Boone, Bull. Vanderbilt Mar. Mus., vol. 3, p. 106, text fig. 2, pl. 32, 1930; Bull. Amer. Mus. Nat. Hist., vol. 63, p. 166, fig. 13, 1931 (= *P. occidentalis* Streets).

Inasmuch as the species known as *P. brevirostris* on the west coast and *P. brasiliensis* on the east have in common a character, the lateral rostral sulci extending nearly the full length of the carapace, which serves to distinguish them from all other penaeids in their respective ranges, a comparison of the two might have been expected to show something of interest. This expectation has been realized, for the two appear to be representatives of one and the same species. There seem to be no positive characters by which they may be distinguished one from the other, despite the fact that

specimens of approximately the same size, of each sex, from both coasts have been compared. The Pacific specimens, *brevirostris*, seem as a rule to run a little heavier in body, a little longer in rostrum, with lateral rostral sulci usually narrower and with a tendency to fade out behind. But on either coast in a large series of specimens there is variation enough, if only found in occasional specimens, to blot out any differences that appeared at first to be worthy of consideration. The rostra, their toothing, spination of the legs, the subhepatic ridges, and other features of the carapace, the exopodites and mouth parts were all examined. For example, in specimens of the same size, the Atlantic specimens in general seem to have lateral rostral sulci which on the carapace proper are relatively twice the width of those of the west coast, and moreover at their hinder ends sharply marked off from the general surface of the carapace; the west American specimens have narrow sulci which at their posterior ends pass over more or less gradually into the surface of the carapace, yet from several of the West Indies and from off the coast of Brazil we have good series of *P. brasiliensis* with the narrow Pacific type of rostral sulci.

There seems likewise to be no tangible difference in the relative stoutness of the legs, a character referred to by Holmes in describing his *P. californiensis* and contrasting it with *P. brasiliensis*. The petasmae and thelyca, allowing for expected variation and growth stages, may well be considered identical. I am not unmindful of the fact that the thelycum of either of the species here united in general character is like that of certain Indo-Pacific and Australian species, *P. latisulcatus*, *esculentus*, and *plebejus*, but no such differences as distinguish those three are to be found in the Atlantic and Pacific material at hand.

It was not until this study had been about completed that I became aware of the fact that Verrill had already (1922) placed Kingsley's *brevirostris* in synonymy with *P. brasiliensis*. He does not otherwise comment upon his action, nor does he include the Pacific distribution in his résumé of the range of *brasiliensis*.

A somewhat parallel distribution of another common West Indian form is that of the stomatopod, *Gonodactylus oerstedii* Hansen, which has been found to be not uncommon on the West Coast, particularly in the Gulf of California, where *P. brasiliensis* (= *P. brevirostris*) also abounds.

In the Pacific *P. brasiliensis* ranges from San Francisco, California (Holmes), Santa Monica and San Diego, to the Bay of Sechura, west of Mataballa, Peru, including the Gulf of California, Bay of Panama, and the Galapagos Islands. The largest Atlantic representative I have personally examined is about $5\frac{3}{4}$ inches (145 mm.) long, however Mr. Milton B. Lindner, in charge of the Louisiana shrimp investigations of the U. S. Bureau of Fisheries, tells me that *P. brasiliensis* attains a maximum size of about 200 mm.; the largest Pacific about 7 inches (177 mm.), Miss Rathbun (1910) cites one of 190 mm. in length. The rostral armature is usually or normally $\frac{9-10}{2}$; occasionally, or even rarely, specimens may be found with 8 or 11 teeth above, and 1 or 3 below, these ventral variations are perhaps abnormal; usually there are four teeth on the carapace behind the orbital margin. The post rostral carina is more or less sulcate; in

specimens where this groove is pronounced the carapace may appear plainly trisulcate.

Penaeus occidentalis Streets.

Penaeus occidentalis Streets, Proc. Acad. Nat. Sci. Philadelphia, vol. 30, p. 343, 1871.

Penaeus brevisrostris Boone, Bull. Vanderbilt Mar. Mus., vol. 3, p. 106, text fig. 2, pl. 32, 1930; Bull. Amer. Mus. Nat. Hist., vol. 63, p. 166, figs. 13, 14, 1931.

Through the kindness of Dr. H. A. Pilsbry I was enabled to examine the type lot of specimens upon which Streets based his original description, and so here to identify with them a considerable series of specimens purchased in the public market at Panama while a member of the Hancock Galapagos Expeditions of 1933 and 1934.

The types are somewhat broken and in rather soft condition; the largest is no more than 124 mm. in length. The specimens purchased in Panama, besides forty which in size are comparable to the types, include four of much larger stature, a male and three females ranging in length from $7\frac{3}{4}$ inches, the male to $8\frac{7}{8}$ inches (171–225 mm.).

Like certain Indo-Pacific penaeids, *P. indicus* young and old as figured by Alcock (Cat. Indian Dec. Crust., pt. 3, fasc. 1, pl. 1, figs. 3, 3a, 1906) and *P. merguensis* de Man (Siboga Exped., monog. 39a, p. 104, 1911), the younger, less mature specimens of *P. occidentalis* have a rostrum relatively much longer than the more developed fully grown individuals.

In smaller, younger *P. occidentalis* the great part of the free portion of the rostrum is before the cornea, while in the larger, fully matured specimens the reverse is true, and the rostra which in youth markedly exceeded the antennular peduncle scarcely exceed it if they do not indeed fall short of the distal margin of its terminal segment.

The four large specimens from Panama have from ten to twelve rostral teeth above, two had eleven, while below there are three well marked ones with the suggestion of a fourth near the tip. Though not readily perceptible to the eye, except on close inspection, the latter can be readily felt in passing the edge of one's finger nail along the lower margin of the rostrum. In one of the four specimens this fourth ventral tooth was evidenced by a little notch in the lower margin, no more. The lateral rostral sulci run backward to a point behind the first dorsal rostral tooth, the outer ridge either side forming them is very strong, especially in small specimens, far more so than in the related west coast species. The thinner and longer of the antennular flagella are no longer than the antennular peduncles.

The petasma has been quite well figured by Miss Boone for specimens of this species which she mistakenly assigned to *P. brevisrostris*, but her figure of the thelycum in no way gives the semblance of the one characteristic of the species. In immature individuals it is a convex, gently bowed up, shield-shaped plate with a slightly raised posterior margin and a medially raised longitudinal ridge which fades out before the middle of the shield (pl. I, figs. 1, 2). The sternal plate of the young not fully developed

males is quite similar in appearance. In mature females this shield becomes an irregularly radially ridged, or plicate, somewhat soft, more or less hairy plate which to first appearances might be taken to be an attached spermatophore, but it is the thelycal plate itself (pl. I, fig. 5). The bases of the last two pairs of legs have small knob-like projections; those of the last pair are tipped each with a conspicuous hair tuft.

Of this species I have further examined a fairly large male from Punta Arenas, Costa Rica, originally determined as *P. stylirostris* for Dr. Manuel Valerio, the collector, at a time when the correct status of these several Pacific penaeids had not yet been satisfactorily cleared up, and a large, but much broken, female from Panama caught Oct. 27, 1933, in about 15 feet of water, near rocks, by Constant Greco, Sr., of New Orleans, and received through the kindness of Mr. Milton J. Lindner of the U. S. Bureau of Fisheries. This last mentioned specimen, despite the impossibility of accurately measuring it in its much broken condition, appears to have been something in excess of 9 inches in length.

Penaeus stylirostris Stimpson.

Penaeus stylirostris Stimpson, Ann. Lyc. Nat. Hist., New York, vol. 10, p. 134, 1871.

not *Penaeus stylirostris* Boone, Bull. Amer. Mus. Nat. Hist., vol. 63, p. 169, fig. 15, 1931 (= *Xiphopeneus riveti* Bouvier).

There is but little to add to the author's original account. His description of the thelycum unmistakably fixes the species. "In the female the feet of the last three pairs bear lamelliform processes on the inner sides of the coxae, and the sternum between the bases of the posterior feet bears a short but much projecting dentiform median carina."

The rostrum reaches forward in young specimens of about 70 to 80 mm. to a third of the length of the free portion beyond the antennal scales, growing shorter with size and development, so that in specimens of 7½ inches (190 mm.), falling short of the scale, it will be no longer than the antennular peduncle. The rostral teeth with rare exceptions, two out of thirteen specimens, will number eight above, two specimens had nine, while a fourteenth one with an abnormal rostrum had 4 above and 3 below. Usually there are 4 teeth on the ventral margin. Two out of five specimens had 5, but these had only 8 teeth above; the fifth ventral tooth in both these cases is a tiny one quite close under the extreme tip. The distal half of the rostrum, more or less, is unarmed. The lateral rostral sulci, as in *P. occidentalis*, run back behind the first dorsal tooth; the first three dorsal teeth are on the carapace. The thinner, longer antennular flagellum is about as long as the carapace. The petasma is simple. Two males, which had the two leaves or lobes forming the adult petasma united, had a petasma greatly resembling that of the Indo-Pacific *P. semisulcatus*.

The largest specimen I have seen is a female full seven and a half inches (190 mm.) long, from Mazatlan, Sinaloa, Mexico, Carlos Stansch, Sr. collector. The farthest north specimens to my knowledge are five that were obtained for the National Museum by the former U. S. Consul Bartley

F. Yost, at Guaymas, Sonora, Mexico. The species is apparently not uncommon along the coasts of Mexico and Panama; aside from various other places along the coast, there are at hand about half a dozen specimens from Mazatlan other than the one mentioned above, received through the kindness of Mr. W. E. Chapman, former U. S. Consul, and Señor Jesus G. Ortega of that place, and as many more from the Canal Zone collected by Drs. Meek and Hildebrand in the course of the Smithsonian Biological Survey. Specimens which have been assigned to this species from off Costa Rica and Peru are quite young, small and immature, so that they can not with absolute certainty be excluded from *P. occidentalis*. I believe them to be correctly determined as *P. stylirostris*. The salt creeks at La Palisada, near Tumbes, are the known southern limit of the range of the species.

Penaeus balboae Faxon.

Penaeus balboae Faxon, Bull. Mus. Comp. Zoöl., vol. 24, p. 211, 1893; Mem. Mus. Comp. Zoöl., vol. 18, p. 181, pl. 47, fig. 1-1c, 1895.

For the present this species seems best accommodated as Faxon has it in *Penaeus*, though in external appearance at least, it does differ in several particulars from what has been recognized as the general or normal facies of the genus.

Faxon has fully described and figured the species with the exception of the rostrum which in his unique holotype lacked the distal extremity.

There are seven specimens, three males and four females, of *P. balboae* in the collections of the National Museum determined by Dr. Mary J. Rathbun which were also taken by the *Albatross* off the Gulf of Panama, but on an earlier cruise and at the surface, April 1, 1888, Surf. sta. 25, Lat. 4° 18' N., Long. 85° 14' W. Faxon's specimen came up in a dredge haul made at 770 fathoms, March 1, 1891, Sta. 3371, Lat. 5° 26' 20" N., Long. 86° 55' W.

The tip of the rostrum extends nearly to the end of the second joint of the antennular peduncle or falls a bit short of it. Above the rostrum is armed with 16 and below with 4 to 5 teeth. Thus it would appear that Faxon's type lacked but the distal half of the free portion of the rostrum; the ventral teeth are all before the distal margin of the cornea.

Penaeus vannamei Boone.

Penaeus vannamei Boone, Bull. Amer. Mus. Nat. Hist., vol. 63, p. 173, fig. 16, 1931.

Miss Boone's species is based in part on specimens in the collections of the American Museum which I had labelled as representing a new species some years before and of which the National Museum was permitted to retain one of the four immature males collected by Señor M. Gallegos, Mar. 23, 1920, in the Estero de Caliquey, Escuinapa, Sinaloa, Mexico, and presented by him to that institution.

The figure accompanying the original description of the species is in-

correct in showing the lateral rostral sulci extending backward behind the first rostral tooth. Usually they terminate about on a level with the tip of the first rostral tooth, and at most do not extend behind the base of the anterior margin of that tooth. The given magnification of the figure is also in error. The type is stated to be about four inches long (101 mm.±). The figure measures easily double that. The rostrum of the figured specimen is exceptionally short. Often, especially in larger specimens, it exceeds slightly the antennular peduncle; in none of the specimens I have examined does the rostrum fall short of the terminal joint of the peduncle. Young specimens do not seem to have the relatively longer rostra found in the young of *P. occidentalis* and *stylirostris*.

As has been stated, *P. vannamei* is the Pacific analog of *P. setiferus*. The combination of rostral teeth most frequently met with in both species is $\frac{9}{2}$. Although some authors grant *P. setiferus* a range in number of dorsal teeth up to 10, there are usually 8 or 9. In *P. vannamei*, on the other hand, the total count is either 9 or 10. In the latter, furthermore, with but one doubtful case in more than a dozen specimens, the first four rostral teeth are situated on the carapace proper, behind the orbital margin. *P. setiferus* seems less particular in this regard, 3 or 4 lying posterior to the orbital margin. I have personally seen no exception to the rule of two ventral rostral teeth in either species. However, those of *P. vannamei* are closer together than in its analog. In the former they are about as close together as the second and third dorsals, while in the latter they are farther apart, approaching more in separation the distance between the first and second dorsals.

A mature male is yet to be described. Though a considerable series of specimens have passed through my hands and I have seen not less than eight males of fair size, up to 128 mm. in length, in none have the right and left lobes of the petasma yet become united with each other. Thus it is left for the female to furnish in the structure of its thelycum the means of best distinguishing this species.

In *P. vannamei* the plate between the fifth pair of legs has an anterior median horse-shoe, or U-shaped depression, open end forward, which medially may show a very faint ridge anteriorly raised to form a low obscure tubercle; the anterior margins or ends of the raised portion of the plate encircling the depressed area form each a somewhat semicircular, more or less perpendicularly upturned lobe. The coxae of the fourth legs are produced to form two somewhat disciform, though not large, projections which tend to overhang and in part hide from view the base of the obliquely anteriorly directed, distally rounded, trough-shaped plate arising from the thoracic sternum between that pair of legs. I am tempted to liken it to the back of a Spanish comb. It is quite the chief character of this species as compared with other American penaeids.

Beyond the four specimens belonging to the American Museum, some forty odd, all told, have been examined, nearly all from the coast of Sinaloa, Mexico, whence they were secured through the kindness of two residents of Mazatlan, Señor Jesus G. Ortega and Mr. W. E. Chapman, former U. S.

Consul, and Señor Carlos Stansch, Sr., of the Dept. Forestal y de Caza y Pesca, Mexico, D. F., at the time located at Teacapan.

Mazatlan seems to be about or near the northern limit for this species, for it is not represented among the penaeids secured by the former American Consul at Guaymas, Sonora, Mr. Bartley F. Yost, from the shrimp fisheries in that vicinity. There *P. stylirostris* is the commercially utilized species. To the south *P. vannamei* ranges at least to the Bay of Panama, for the specimen that Miss Boone took for the type of the species was purchased in the market at Panama City. The National Museum has also a young female from Corozal, Canal Zone, April 18, 1911, Meek and Hildebrand, Smithsonian Biological Survey, collectors.

Señor Stansch also kindly furnished us with a color sketch of this species, showing the normal whitish-greenish bronze-flecked, translucent coloration, and another of a color phase of this same species, a beautiful light cerulean blue, becoming lighter toward the underparts, stippled with a darker blue of the same sort; as in the normally colored individuals, the antennal flagella are a reddish brown, and the distal margins of the uropods are tinged with red.

This species first came to my attention back in 1919 when Mr. R. A. Coleman, then the U. S. Bureau of Fisheries agent at San Francisco, California, submitted several samples of commercial dried shrimp in the shell for identification. The demonstrable characters precluded their identification with any of the then known species of *Penaeus*. Pains were taken to secure fresh material through the intermediation of the State Department, which led to the contacts established with the several gentlemen here referred to.

In a report on "The Shrimp Industry at Mazatlan," Daily Consular and Trade Reports, Dept. of Commerce, No. 198, Aug. 24, 1917, U. S. Consul W. E. Chapman gives some information regarding the commercial utilization of this shrimp:

"There are some 40 or 50 shrimp fisheries along the Pacific shore line within this consular district, with the trading center of the industry at Mazatlan. Most of the shrimp are collected during the rainy season—from July to November—in numerous shallow lagoons along the seashore. They are brought in from the adjacent waters of the Pacific Ocean by the currents. It often happens that there are large areas of the sea literally filled with them.

"All lagoons utilized in catching the shrimp are traversed at the inlet by a dam with two rows of light piling about 4 feet apart filled in with enough fine brush to prevent the shrimp passing through. Depending upon the length of the dam, one or more traps of the ordinary style of lobster trap are located at convenient intervals for allowing the shrimp to enter the lagoon and at the same time for catching them when the fishermen are ready to take them from the water. When they first enter the lagoons from the sea they are usually small, although in some seasons they are large enough for immediate use.

"The lagoons produce a weed or grass that grows from the bottom and is known locally as paiste. Immediately upon entering the lagoons the shrimp begin feeding upon this weed so that in seasonable years the average length of the shrimp increases to about $4\frac{1}{2}$ inches.

"Unlike the ordinary species of fish, shrimp move with the currents of water in which they are found. Therefore the fishermen watch for the rising of the tide to open the entrances through the dams and the falling of the same to close them.

"When the shrimp have reached full growth in the lagoons the fishermen set their traps and again utilize the force of the tide, this time the outgoing one, in making the catch. At each trap, if there are men enough, one man uses a sort of basket fastened to the end of a pole with which to dip the shrimp from the trap and deposit them in a canoe. Generally several canoe loads are taken to camp by each man at each tide, making it possible for a few men to gather several tons in a day.

"Many of the smaller operators in the shrimp industry catch with nets ranging from 100 to 400 feet in length, either in the lagoons or in shallow water along the open seashore.

"When the shrimp season is good, as is usually the case, it is not uncommon for 10 men to catch 20 tons of shrimp in a period of eight hours, using the hand nets. Of course this success can be attained only on such occasional days as the shrimp happen to drift within the scope of operations.

"The shrimp industry in this district provides three forms of the preserved product for the trade, namely (a) Mexican shrimp which is salt-dried and so called because it is produced principally by Mexican fishermen and used almost exclusively in the Mexican trade. It is packed in mat bags with the head and shell on and is first in importance among the three products. (b) China shrimp, which is cooked with a little salt and then dried with the head and shell removed. It was so named because it is produced by the Chinese to some extent and is prepared for the use of the Chinese in Mexico, the United States, and even in China. China shrimp is second in importance. (c) Canned shrimp, which is prepared for the market in the United States at a few small canneries located at points adjacent to the fisheries. All of the canning factories are operated by Americans.

"One American concern that has been in the shrimp-canning business during the past three or four years, having a plant with a daily capacity of 5,000 cans, is taking steps to reorganize for the purpose of increasing its output to about 20,000 cans daily. It will install can-closing machinery. The closing of shrimp cans in the past has been done by hand.

"The shrimp industry in this district, however, is not carried on without some difficulties. The foreigner can not succeed unless he has a good command of the Spanish language, a good knowledge of local conditions affecting the business, and plenty of capital with which to work. Catches will be lost if exposed to heavy rains during the process of drying in the case of Mexican or China shrimp, or before the canned shrimp are put up unless some method of covering is employed at a heavy cost. Another difficulty is the matter of gauging the number of laborers necessary to the success of the season or of the particular catch, as several thousand dollars may be lost in shrimp over night due to insufficient help.

"The shrimp industry appears to be in its infancy, and is conducted on a small scale in this section of Mexico, handling only about 10 per cent of the available supply."

Among the Sinaloa peneids, *P. vannamei* predominates, with *P. brevisrostris*, now *braziliensis*, a fairly close second. That the former is apparently the mainstay of the fishery is borne out by the fact that several samples of the dried shrimp from Mazatlan proved to be that species, and that the commercial shrimp exhibited in the Mexican Exhibit at the World's

Columbian Exposition in Chicago in 1894 were likewise this species. There were three males and a female in this particular lot, of which one of the males, noted above, was the largest of the species and of its sex that I have seen, 128 mm. in length—Señor Stansch, quoted below, gives the maximum length of the species as 25 cm. (nearly 10 inches!). These specimens were only recently located among some of the unidentified materials in this Museum, but had been labelled at the time of their receipt by Dr. Mary J. Rathbun as *Penaeus* near *setiferus*.

One of the specimens of *P. vannamei* received from Señor Stansch was accompanied by the following note in Spanish: "From the end of March onward this species of shrimp enters the mouths of the rivers and streams. It is then 1 cm. in length, more or less, and very transparent. It goes as far as the mouths of the most distant estuaries, as much as 50 km. from their mouths. During the months from May to September it lives in the estuaries and lagoons, growing to its normal size, which is from 12 to 25 cm. long. Its food consists of vegetable elements (algae), animals (entomostraca, hydrozoa), and [detritus]. Toward the end of August they start on their way back to sea."

Notes on the shrimp fishery at Guaymas, Sonora, Mexico, where *P. stylirostris* would seem to be the important species, and Topolobampo, Sinaloa, from which place I have no specimens, by Bartley F. Yost, U. S. Consul at Guaymas, as of August 15, 1922, are issued in the form of a mimeographed circular (Mem. S-226) by the U. S. Bureau of Fisheries.

EXPLANATION OF PLATES.

Plate 1.

- Fig. 1, 2. *Penaeus occidentalis*, young females, 4/5ths natural size, two of Streets' types from Panama (McNeill Exped., No. 73, Acad. Nat. Sci. Philadelphia).
- Fig. 3, 4. Same, thelyca, respectively of preceding, x 2.4.
- Fig. 5. *Penaeus occidentalis*, fully developed, mature female, x 2.4, purchased in Panama.
- Fig. 6. *Penaeus vannamei*, thelycum of female, nearly x 4, Mazatlan, Mexico, Aug. 1923, Jesus G. Ortega, coll., W. E. Chapman, donor.
- Fig. 7. Same, thelycum of another female, nearly x 4, Mazatlan, Mexico, Carlos Stansch, Sr., Sec. Agr. Fom. Sec. Estud. Biol., Mexico, D. F. coll. & don.
- Fig. 8. *Penaeus stylirostris*, thelycum of mature female, about x 2.4, Mazatlan, Mexico, Carlos Stansch, Sr., Sec. Agr. Fom. Sec. Estud. Biol., Mexico, D. F., coll. & don.

Plate 2.

Penaeus occidentalis, fully developed mature female, 4/5ths natural size, purchased, Panama. (Thelycum of this specimen is figured pl. 1, fig. 5.)